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The Anaconda Company's Proposal
For Development of the Heddleston
Mining District, Lewis & Clark County,
Montana

Briefing, March 18, 1970

The State Board of Land Commissioners, at the meeting of March 2, 1970, recommended that the Water Resources Board and two other State agencies review the easement request of the Anaconda Company, and participate in public hearings, for the purpose of reporting on the impact of the request and the possibility of pollution.

The staff of the Montana Water Resources Board has reviewed the available information, and reports the results of the review in this presentation.

It should be mentioned that even though the Director of the Montana Water Resources Board is a member of the Pollution Control Council, the Water Resources Board does not have any legal or statutory responsibility for pollution control. However, the Board does have many responsibilities in the field of water resources, and we are vitally interested in all developments which have a bearing on Montana's water resources. We are grateful for the opportunity to be able to participate in this briefing.

In order to review the request, we felt it necessary to gather basic data from whatever source available to us.

We contacted the Anaconda Company for data, and the Company supplied information that was available. We realize that Anaconda's design plan is only preliminary and subject to revision, and that much more detailed engineering analysis will be required before the Company will know exactly all that will be involved in the mine-mill operation.

We also contacted the Soil Conservation Service offices in Helena and Bozeman, the U. S. Geological Survey in Helena, the Helena Weather Bureau and others, for basic data. Everyone we contacted cooperated graciously.

The easement request is for all of Section 16, Township 15 North, Range 7 West, and an additional 40 acres in the NW¼ of the NE¼ of Section 4, Township 14 North, Range 7 West. These State lands are to be used for Company operations in what is known as the Heddleston Mining District.

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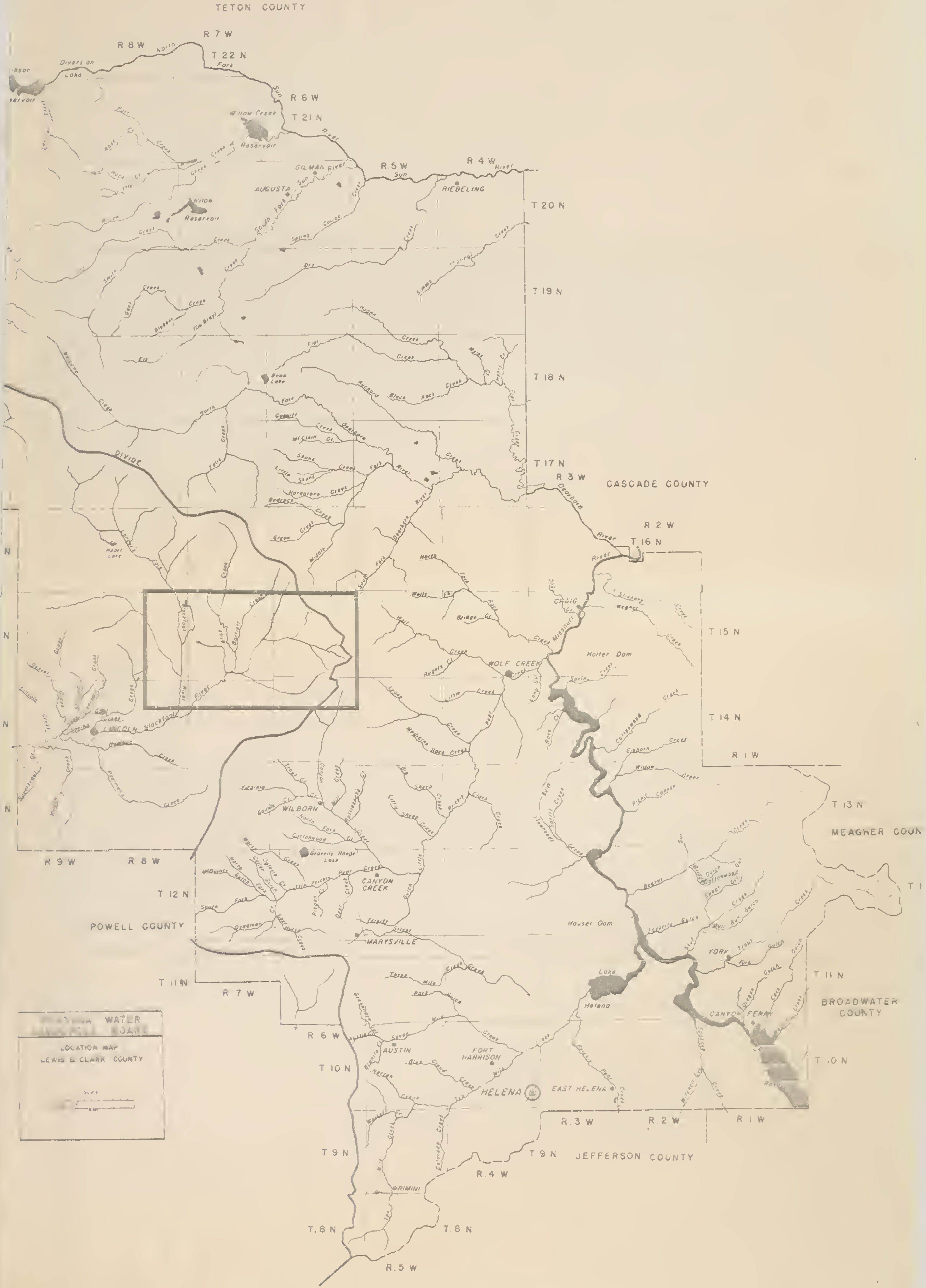
MONTANA WATER RESOURCES BOARD
LOCATION MAP
LEWIS & CLARK COUNTY
SCALE
TETON COUNTY
CASCADE COUNTY
MEAGHER COUN
BROADWATER COUNTY
JEFFERSON COUNTY
POWELL COUNTY
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Willow Creek Reservoir
Nilan Reservoir
AUGUSTA
GILMAN
RIEBELING
Bean Lake
Sun River
North Fork
South Fork
Dearborn River
Missouri River
Blackfoot River
LINCOLN
WOLF CREEK
CRAIG
Holter Dam
Hauser Dam
Lake Helena
CANYON FERRY
YORK
WILBORN
CANYON CREEK
MARYSVILLE
Gravelly Range Lake
AUSTIN
FORT HARRISON
HELENA
EAST HELENA
RIMINI
Little Prickly Pear Creek
Medicine Rock Creek
Wolf Creek
Cottonwood Creek
Spring Creek
Beaver Creek
Trout Creek
Ten Mile Creek
Silver Creek
Dry Creek
Smith Creek
Flat Creek
Elk Creek
Falls Creek
Rogers Cl.
Wells Cr.
Bridge Cr.

(SLIDE ONE)

The first slide shows most of Lewis and Clark County, major cities and towns, the Continental Divide, rivers and streams, and the approximate area of interest. The proposed development lies about 33 miles northwest of Helena as the crow flies, near the head of the Blackfoot River. The town of Lincoln is about 10 or so miles down the Blackfoot River.

The Anaconda Company is investigating the feasibility of mining copper ore by open-pit methods, between Paymaster Gulch and Stevens Gulch, near the old Mike Horse Mine. Anaconda's mining operations will begin in the area shown on the second slide, near the junction of Sections 20, 21, 28 and 29, in Township 15 North, Range 6 West.

(SLIDE TWO)

Operations might at some future date extend the mined area to the south and east, and perhaps even to the north, according to Company estimates. The second slide shows the development area.

Those of you who are familiar with this area know that it lies close to the Continental Divide, on the west slope, among timbered mountain ridges rising nearly 7,000 feet above sea level and dissected by elongated valleys and gulches cut by mountain streams and intermittent runoff.

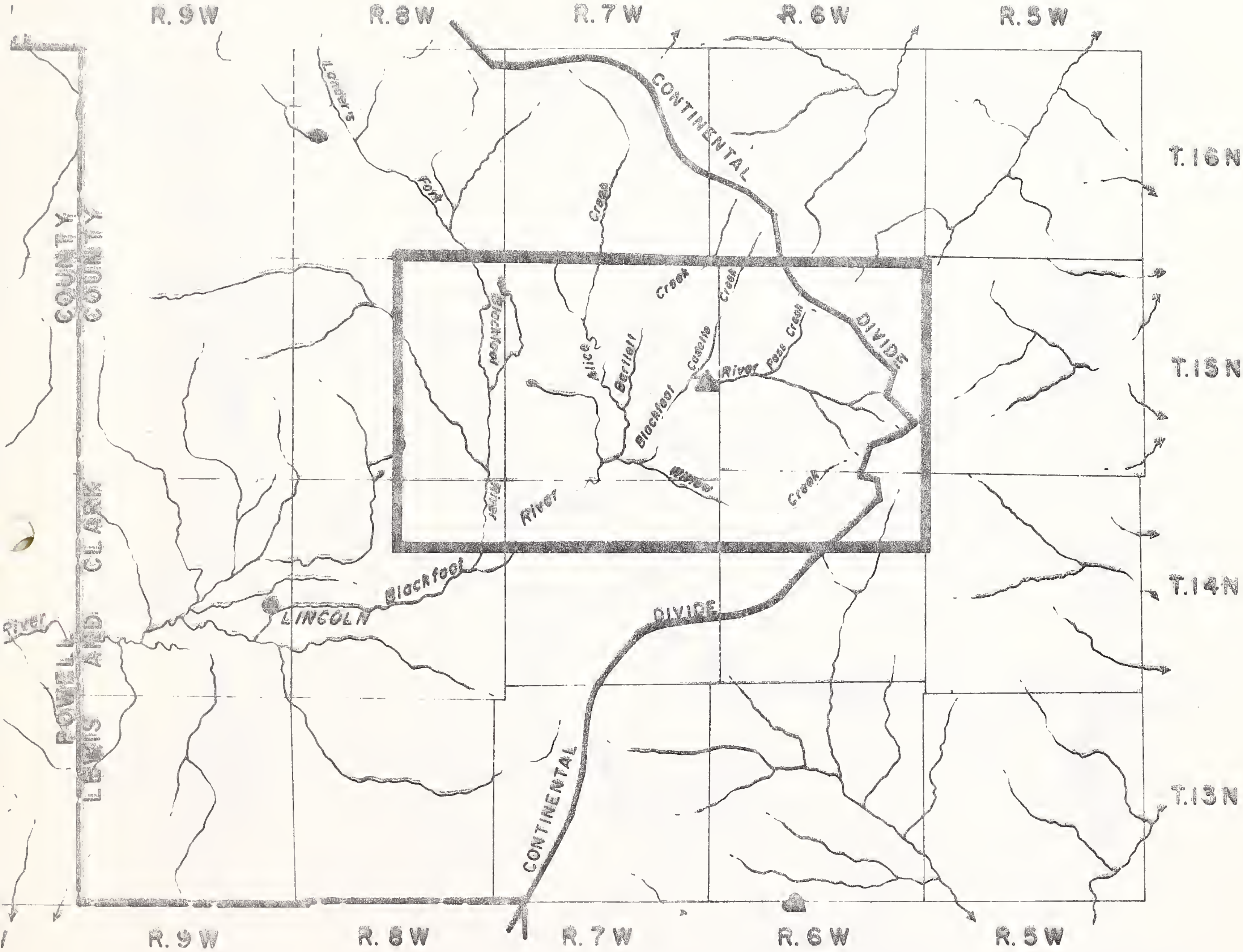
Being west of the Continental Divide, the area drains westward, with water eventually flowing into the Clark Fork of the Columbia.

(SLIDES THREE, FOUR AND FIVE)

The next series of three slides provides an overall picture of the Big Blackfoot drainage, from the headwaters to the mouth. Starting with the headwaters in Lewis and Clark County, the Blackfoot flows through Powell County, then into Missoula County where it joins the Clark Fork. The orange triangle near Bonner represents a U. S. Geological Survey gaging station. The average discharge of the Blackfoot River at this station, reported by the U. S. Geological Survey, amounts to 1,613 second feet, which is equivalent to approximately one million acre-feet per year. Expressed another way, this is 380 billion gallons per year. This amount - one million acre-feet per year - flows into the Clark Fork River, which in turn discharges an average of 15 million acre-feet of water each year across the State line into Idaho.

The use of the water resources contemplated by the Anaconda Company in the Heddleston Mining District, including storage on Alice Creek, and the possible use of minor amounts of other surface water supplies augmented locally by groundwater, does not at this time seem to be incompatible with the State Water Plan.

There is one gaging station on the Blackfoot River within the area of proposed development, maintained jointly by the U. S. Geological Survey and the Montana Fish and Game Department. It is located just below the confluence



MONTANA WATER RESOURCES BOARD

BLACKFOOT RIVER
DRAINAGE MAP

LEWIS & CLARK, POWELL, AND
MISSOULA COS.

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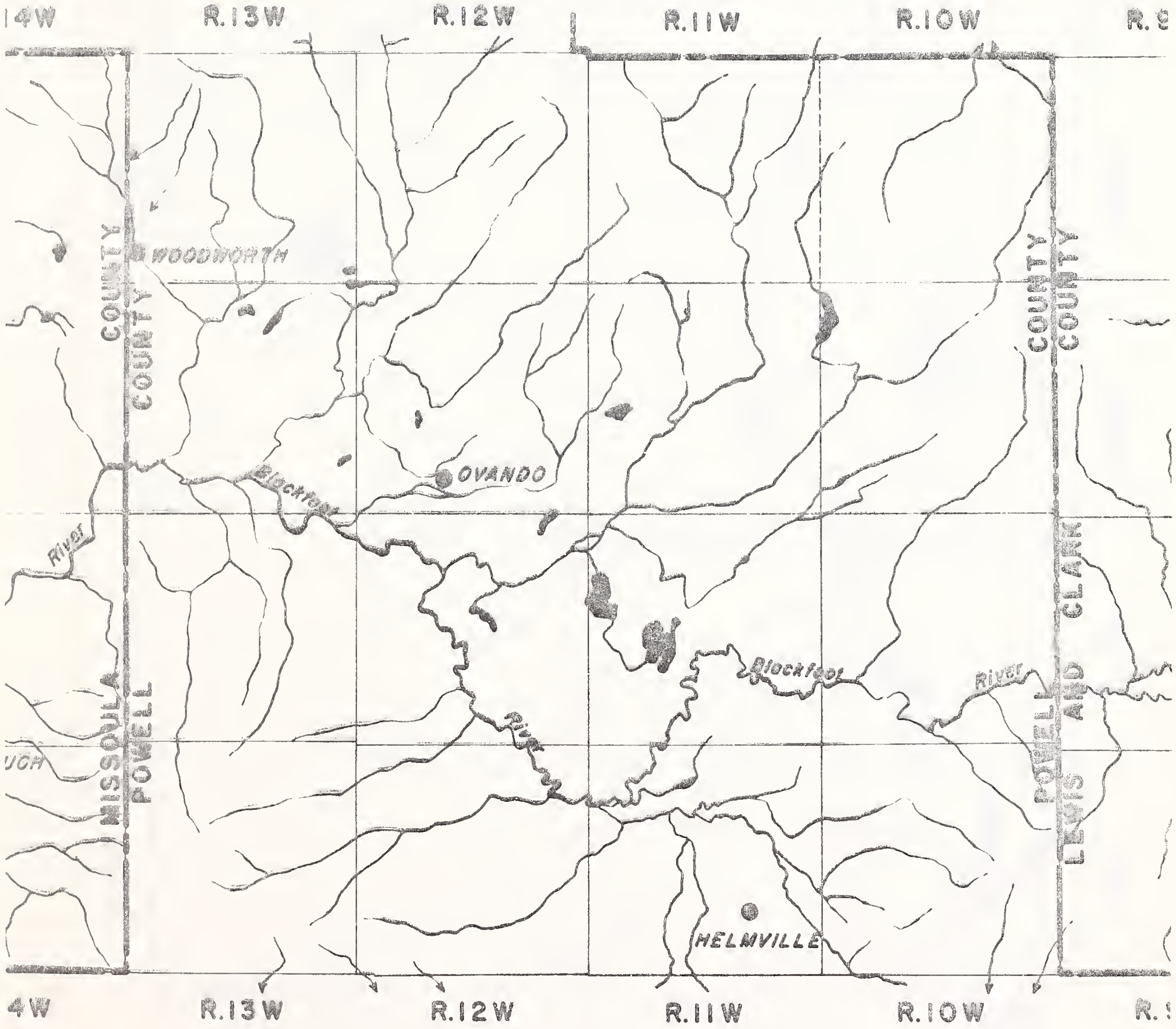
6 Mi



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Blackfoot
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MISSOULA COUNTY
POWELL COUNTY
POWELL COUNTY
LEWIS AND CLARK COUNTY
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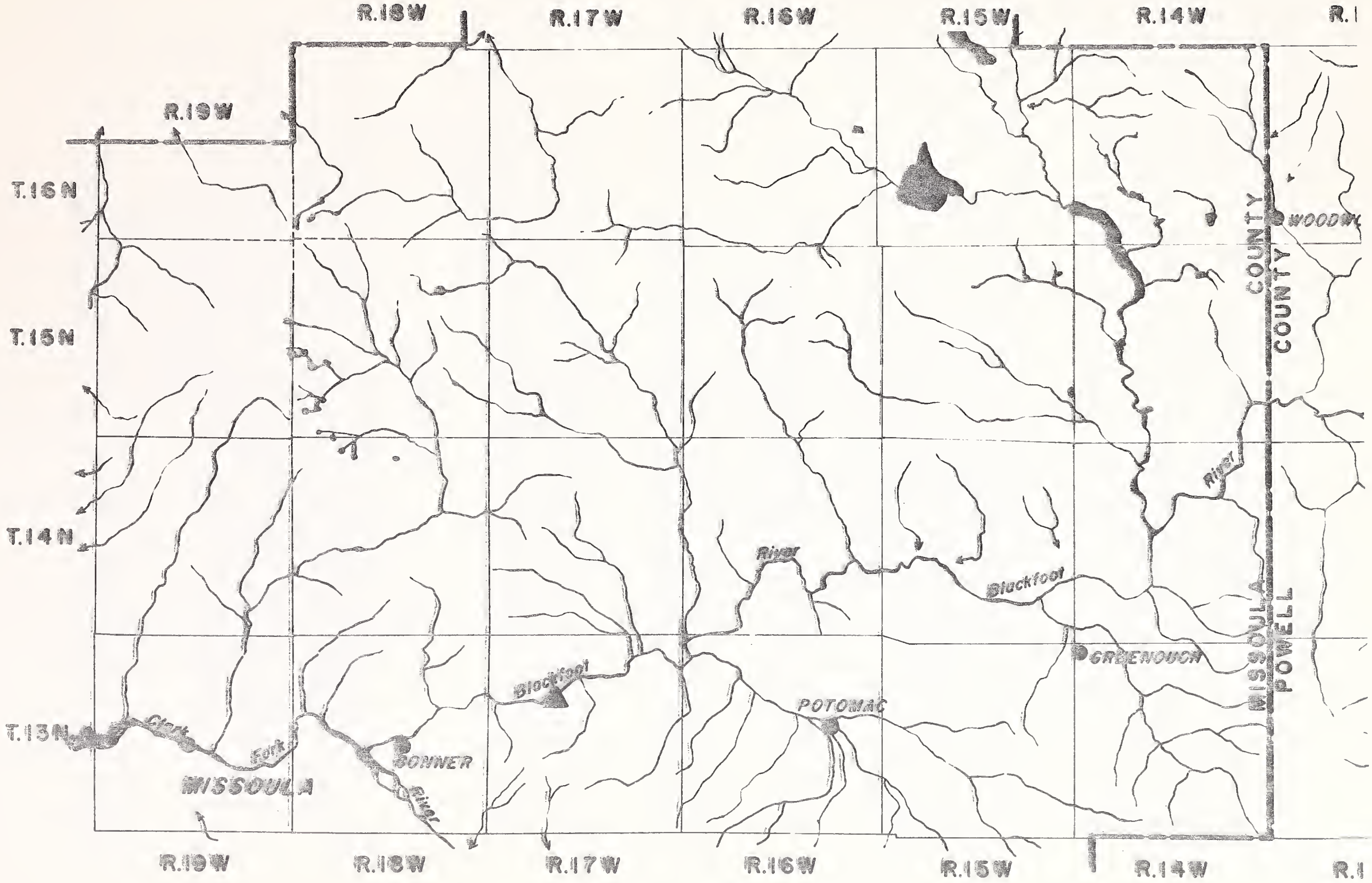
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POTOMAC
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of Surveyor's Gulch with the Blackfoot River, in Section 19, Township 15 North, Range 6 West. In addition, the Anaconda Company has measured flows of tributaries to the Blackfoot River. The average annual flow at the gaging station on the Blackfoot River is about 16 second feet. Downstream, Alice Creek discharges 38 second feet into the Blackfoot, as measured in Section 27, Township 15 North, Range 7 West. Other reported measurements are 2+ second feet from Cadotte Creek, 4 second feet from Shoue (Shave) Creek, and less than 1 second-foot from Pass Creek. These measurements are based on very short historical records, and may be revised in the future. However, they do indicate relative stream flows.

What do we know about the water resources of the area in question? For one thing, we know that precipitation in the mountains, near the Continental Divide north of Alice Creek, is more than 50 inches per year. At lower elevations of the Blackfoot Valley, it amounts to about 25 inches per year. (These figures are based on snow survey and precipitation data provided by the Snow Survey Section of the Soil Conservation Service, and the U. S. Weather Bureau.) Mountain runoff moves into the Blackfoot River. By far, the greatest amount of runoff reaches the Blackfoot River by way of Alice Creek.

Some of the runoff goes underground and adds to groundwater supplies. There are no observation wells presently being monitored, so we have to make inferences on this topic from general observations.

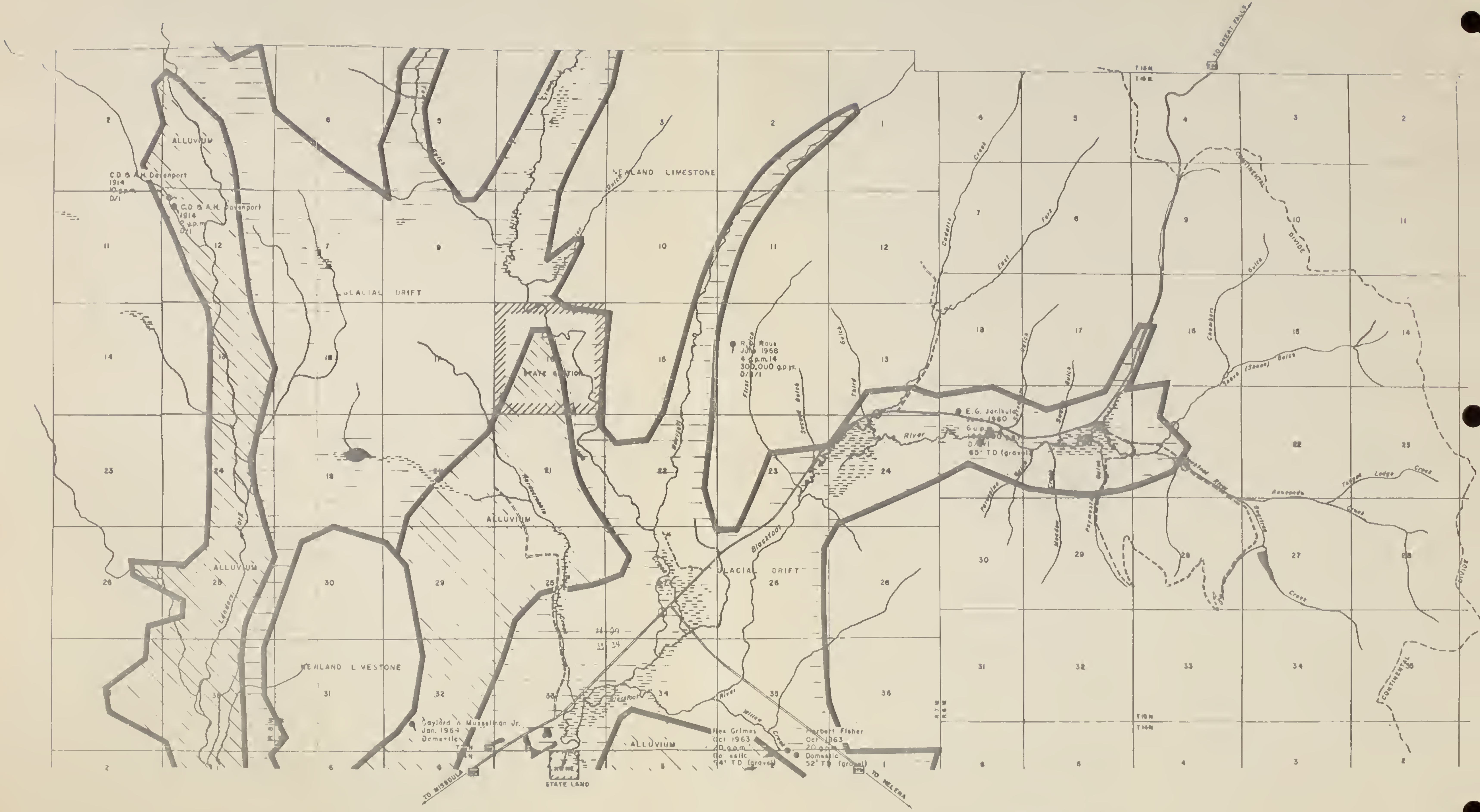
Groundwater conditions in any region are due in large part to the geologic environment, both past and present. The area of the proposed development is part of a region which generally was heavily glaciated during an earlier geologic time.

In the geologic past, glaciers moved southward from the mountains into the Blackfoot Valley. One such glacier is thought to have moved down the valley of Alice Creek and across the Blackfoot Valley, crowding the River against the south bluff. There reportedly was deposited by this glacier a 100-foot high ridge of morainal drift blocking the main valley, in Sections 26, 34 and 35, Township 15 North, Range 7 West.

(SLIDE SIX)

On this slide we have attempted to generalize the surface geology of the area. The white portions represent rocks of the Precambrian Belt Series. The mine will be in this type of rock. The horizontal pattern indicates glacial drift, deposited by glaciers moving southward to the Blackfoot Valley. The slanted pattern shows alluvium, a recent stream-laid deposit. Glacial drift consists of cobbles, gravels, sands, and clays, and sometimes includes layers of water-bearing gravels similar to alluvium. Alluvium is mainly sand and gravel, and normally supplies groundwater to wells. From available information, the alluvium is more than 50 feet thick.

This slide also indicates varying soil conditions. The short dashes show very wet soils, which are poorly drained. The water table here is at or near the surface; the substrata consists of sandy gravels and cobbles which take in



MONTANA WATER
RESOURCES BOARD

large amounts of water from surrounding areas but do not transmit the water outward freely. Gravels in the Blackfoot River Valley, from the headwaters almost to the Horsefly Creek confluence, apparently do not transmit underground water freely. Underground water appears to move more freely through gravels associated with tributaries, such as Alice Creek.

Even though the groundwater levels have not been measured in the past, investigations in similar areas suggest that the water table fluctuates with the surface water level, and the movement of underground water generally is in the same direction as that of surface water.

Within the area of proposed developments, surface water appropriations filed at the County Courthouse amount to approximately 15,000 miner's inches (equivalent to 375 second feet). The earliest appropriation is dated 1891, for 500 miner's inches from Alice Creek. Another early appropriation of record is one by William Heddleston and George W. Padbury for 300 miner's inches out of Pass Creek, for mining and milling at the Caliope Quartz Lode, dated 7-15-1892. None of the included water courses have been adjudicated, therefore none of the appropriations are decreed rights.

We understand that "water rights," including several totaling 6,000 miner's inches from Alice Creek, have been transferred from individuals to the Anaconda Company. Practically all, if not all, the surface water appropriations of record in the area have been conveyed to the Anaconda Company.

Groundwater appropriations have also been made within the area. There are records of filings on two springs and two wells, and more wells in the Blackfoot Valley to the southwest towards the confluence of Landers Fork.

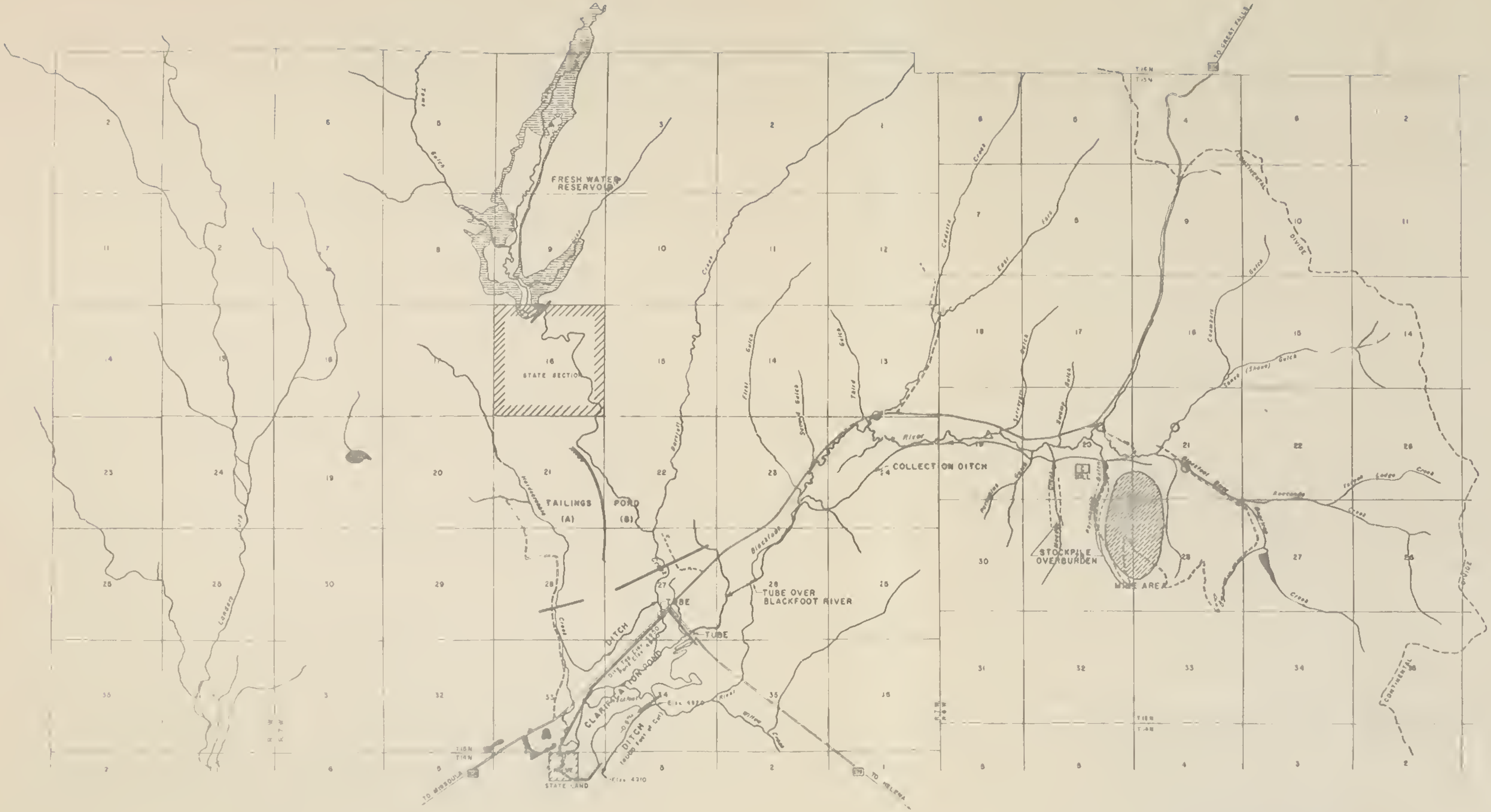
Now, let's look at the proposed development. We previously viewed a slide of the area, and perhaps we can look at it again.

(SLIDE TWO - repeat)

You will note on this slide, three general localities where development is planned.

On the right is the mine locality, between Stevens Gulch and Paymaster Gulch. Between Paymaster Gulch and Meadow Creek to the west will be located a mill. Overburden from the mine is to be stockpiled in Paymaster Gulch and Meadow Creek. The red line between the mine and the Blackfoot River is a collection ditch, which follows the River to a clarification pond, below the confluences of Alice Creek and Hardscrabble Creek. The collection ditch is designed to intercept runoff from the stockpiles before it reaches the River, and carry it to the clarification pond. The design indicates a storage area of about 600 acres, and a maximum depth of 10 feet. The clarification pond is in the Blackfoot River Valley, therefore the design calls for diverting the Blackfoot River through 4,000 feet of cut, perhaps as much as 65 feet deep, around the south end of the clarification pond.

After the ore has been milled, the waste will be carried as a slurry, through



MONTANA WATER RESOURCES BOARD

MAP SHOWING AREA OF
ANACONDA CO PROPOSED
DEVELOPMENT
MARCH 1970

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a pipeline, to the tailings pond. The tailings pond will be developed in two stages, indicated (A) and (B) on the slide. Pond (A) will form behind a dam (or dike) across Hardscrabble Creek, having a crest elevation of about 5,120 feet, retained on the east by a dike between Hardscrabble and Alice Creeks. As the pond grows, a dam (or dike) will be constructed across Alice Creek, and Pond (A) will merge with Pond (B). The pond will be large enough to function for 40 years at maximum production. The tailings pond will encroach into Section 16 on both Hardscrabble and Alice Creeks. The Company is assuming a production rate of 30,000 tons per day. The design also calls for a ditch to divert the lower end of Hardscrabble Creek into the clarification pond.

The flow of Bartlett Creek will be diverted to bypass the tailings pond and the clarification pond, and will be taken north of the highway, through the Hardscrabble culvert at the crossing, into the Flesher Lake area. The plan allows lower Alice Creek to be diverted in this same manner, until such time as the tailings pond is expanded into the Alice Creek valley. If a dam is constructed across Alice Creek, the diversion will then be the same as the lower end of Hardscrabble Creek. According to the Company, this design will keep any possible contaminants out of the fresh water system.

In the northwest quarter of Section 16, the Company plans to build a dam across Alice Creek. The reservoir behind this dam will supply water needed to transport tailings from the mill to the pond. According to the Company, operations will require between 2,000 and 4,000 gallons per minute of new water. A 50-foot dam reportedly will store about 2 billion gallons (6,000 acre-feet) of water behind it; a 100-foot dam would create a reservoir of 6 billion gallons (18,000 acre-feet). On the slide, the white area within the red represents the approximate water area behind the 50-foot dam; the outside red line represents the surface behind a 100-foot dam. These areas are based on the topography represented on the U. S. Geological Survey 7.5 minute series topographic maps, and are subject to interpretation and possible revision as more detailed maps become available.

With a 50-foot dam (crest elevation about 5,330 feet), lower Alice Creek would be diverted into a man-made ditch to bypass the tailings pond. With a 100-foot dam (crest elevation 5,380 feet), Alice Creek could be diverted by ditch to the west, eventually going into Landers Fork.

As we understand the Company's plan, ore will be mined and processed at the mill, overburden will be stockpiled as indicated, and tailings will go to the tailings pond as a slurry. The slurry will move in a pipeline - buried where possible - and water in the tailings pond will be returned to the mill by another pipeline. Fresh water behind the Alice Creek dam will be put in the tailings pond and then be piped to the mill for use. Water in the clarification pond will also be piped to the tailings pond and reused. The Company considers that almost all the water used at the mill will be consumed, at a ratio of one ton of water to one ton of ore. One ton of water is equivalent to approximately 240 gallons of water.

The Company's plan would eliminate discharging wastes directly into the Blackfoot River. This is to be accomplished by (1) an interceptor ditch;

(2) Blackfoot diversion; and (3) a closed pipeline system between the mill and the tailings pond. According to the plan, wastes would accumulate in the clarification pond and the tailings pond. The open ditches and pond areas are to be lined with wet tailings, to make the walls and floors impervious to seepage.

(SLIDE SEVEN)

Here is another view of the mine area and adjacent area. Runoff into Paymaster Gulch and Meadow Creek would pass over the stockpiled overburden before reaching the Blackfoot River. Pollutants, if present, might be carried into the Blackfoot River. However, the ditch between the piles of overburden and the River intercepts the runoff before it reaches the Blackfoot River, collects it, and carries it to the clarification pond, part of which would be constructed on the State land in the NW¼ of the NE¼ of Section 4, Township 14 North, Range 7 West. The Company reports that the ditch can be constructed so that it does not intercept the flow of other tributaries, and that it can be effectively sealed to prevent seepage.

(SLIDE EIGHT)

This is the clarification pond again, and tailings pond to the north. In order for the clarification pond to function and not pollute the Blackfoot River, the River must be diverted around the pond. This is called for in the preliminary plan. The pond would cover the 40 acres of State land in the NW¼ of the NE¼ of Section 4, Township 14 North, Range 7 West.

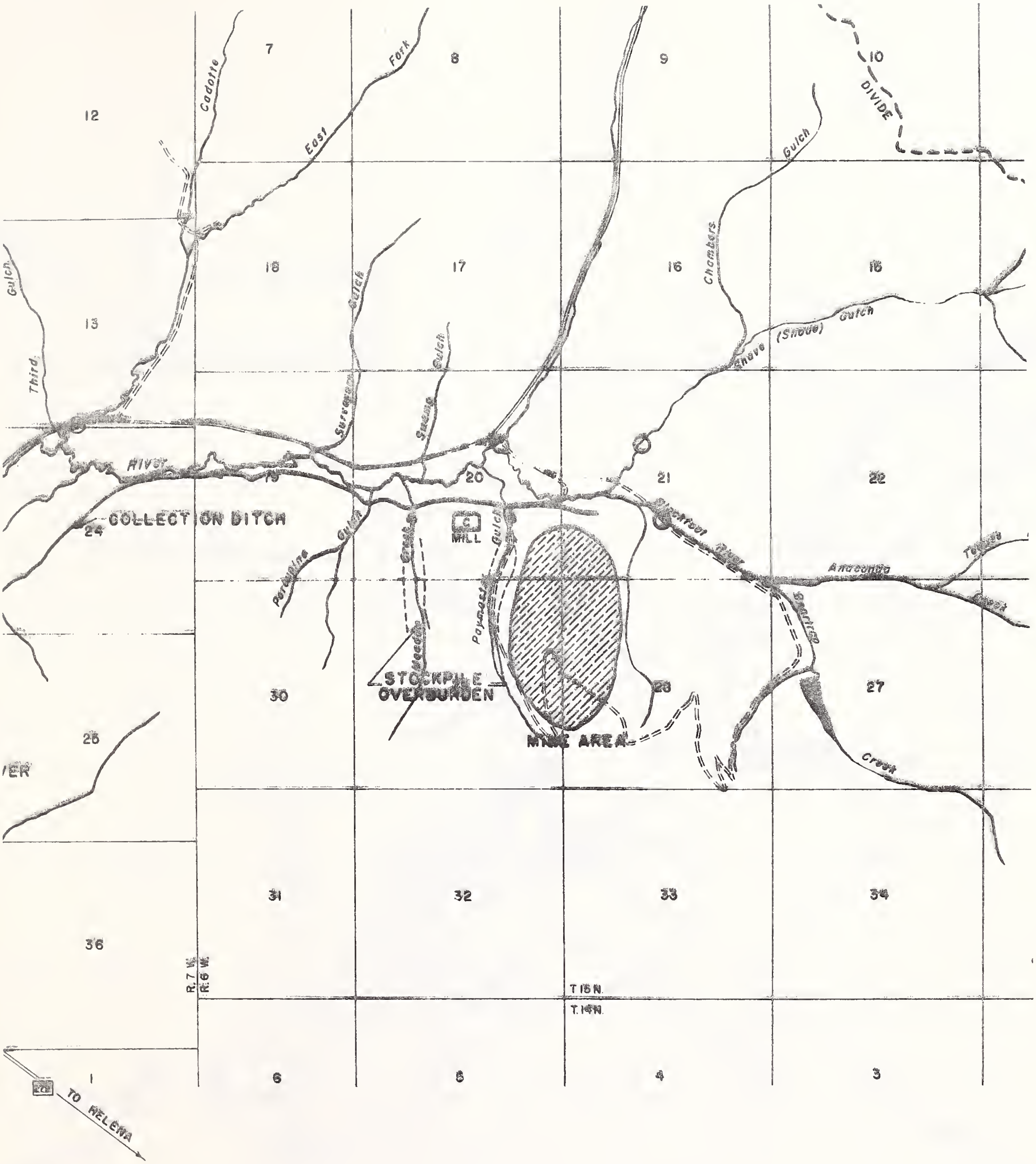
The area to be used as a tailings pond is within the alluvial valley of Hardscrabble Creek, and also the valley of Alice Creek. The design calls for a system of retention dikes. First, a dike across Hardscrabble Creek and a dike between Hardscrabble and Alice Creeks; later a dike across Alice Creek, used in conjunction with the dam across Hardscrabble Creek.

(SLIDE NINE)

The final slide shows the proposed site of a dam and reservoir on Alice Creek. The dam is to be constructed in the northern part of Section 16, on part of one of the State tracts requested. The tailings pond will extend into the southern part of Section 16.

In reviewing Anaconda's request and plans for pollution control, we looked at the water resources of the Blackfoot drainage, pertinent water rights, local geology and soils, and the Company plan.

We recognize that hazards exist, but we feel that adequate engineering can result in proper design facilities to alleviate foreseeable problems. We believe that the Company can design facilities which will serve the Company's purpose and alleviate public concern.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Fork
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Third
Chambers
Gulch
Shave (Shoue) Gulch
Seaman
Gulch
River
19
20
21
22
COLLECTION DITCH
24
MILL
Gulch
Porcupine
Creek
Meadow
Paymaster
Gulch
Blackfoot River
Anaconda
Creek
Beartrap
STOCKPILE
OVERBURDEN
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MINE AREA
Creek
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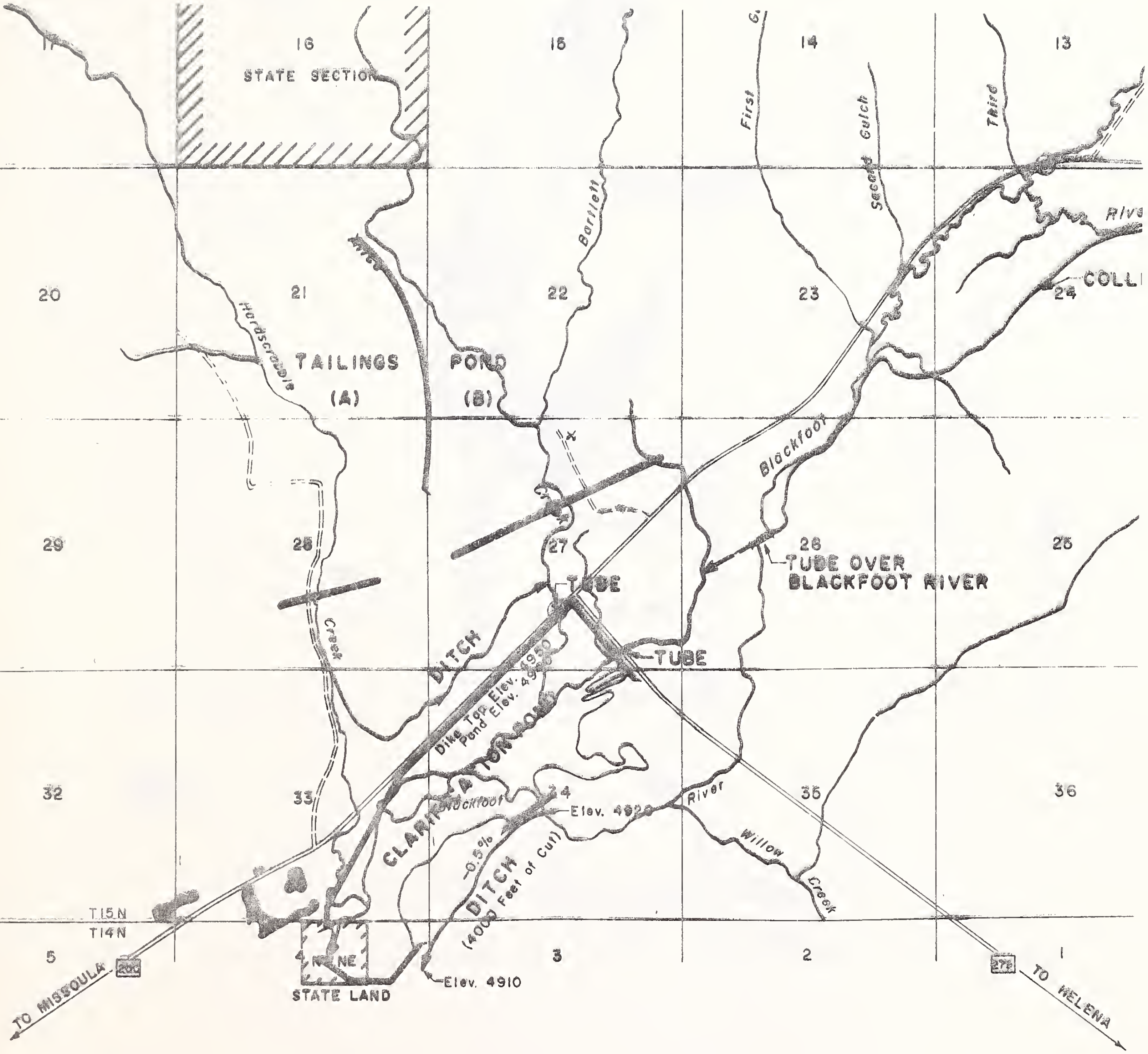
17
16
STATE SECTION
15
14
13
First G.
Second Gulch
Third
Bartlett
Rive
20
21
22
23
24
COLL
Hordscrabble
Creek
TAILINGS POND
(A)
(B)
29
28
27
26
25
Blackfoot
TUBE OVER BLACKFOOT RIVER
TUBE
TUBE
DITCH
Dike Top Elev. 4950
Pond Elev. 49
CLARIFICATION POND
Blackfoot
34
Elev. 4920
River
Willow
Creek
32
33
35
36
-0.5%
DITCH
(4000 Feet of Cut)
T15N
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NE NE
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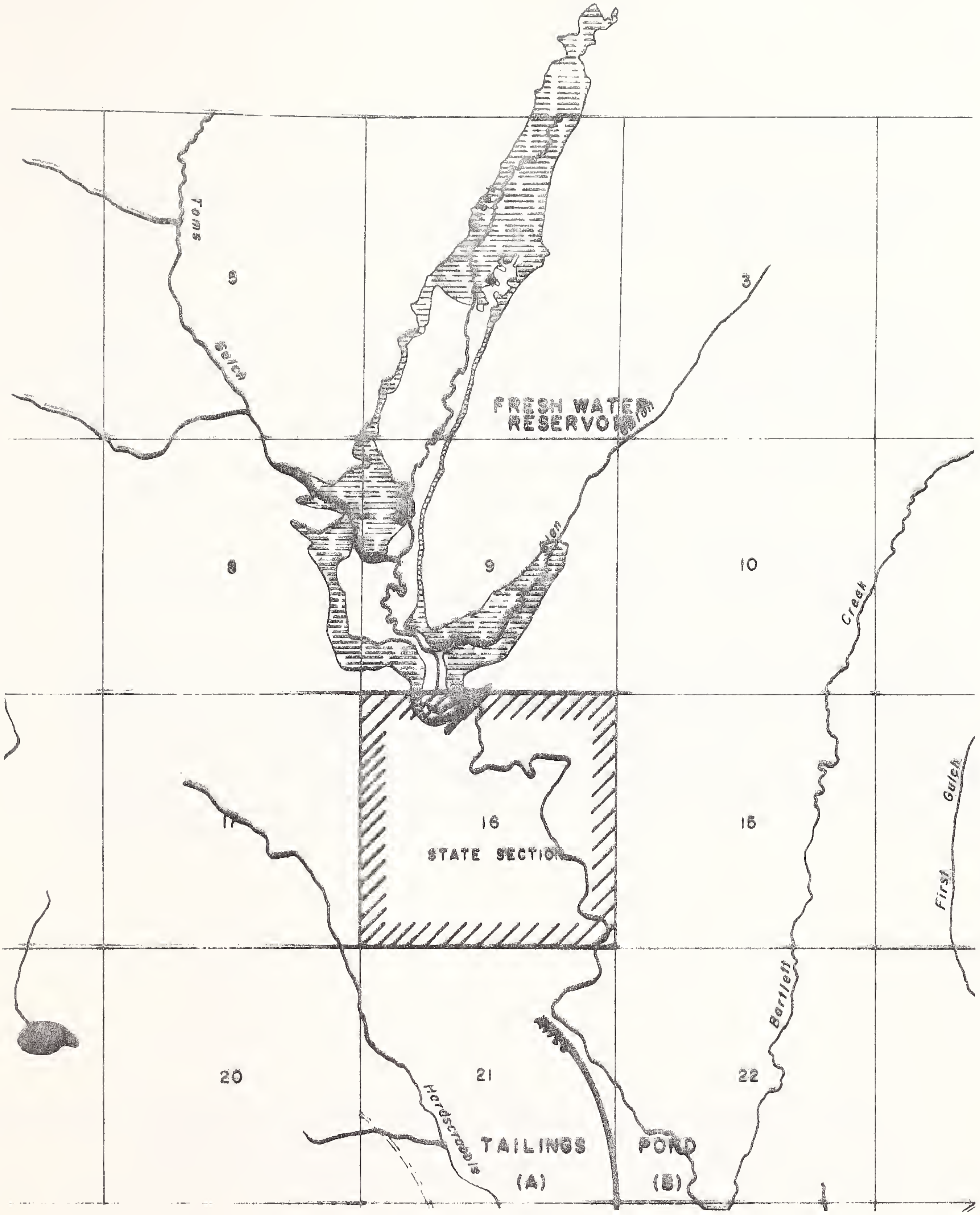
TO HELENA


Toms
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Creek
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STATE SECTION
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Gulch
First
Bartlett
20
21
22
Horseshoe
TAILINGS
POND
(A)
(B)

In summary, we list a number of items that are pertinent, in our opinion:

1. Information on groundwater conditions is lacking; a project of this scope should include basic data on groundwater movement, water table depths and fluctuations, aquifer characteristics, and groundwater quality.
2. Flooding along the Blackfoot reportedly has been investigated by the Company; it would be expected that the floodplain would be used in such manner as not to create a hazard to health or welfare; including the construction of any ditches on the edge of the floodplain at elevations sufficient to be above highwater during a hundred-year flood.
3. The Company should do all it can to convince the Public that the floors and walls of ditches and ponds can be effectively sealed.
4. The final engineering design for diverting the Blackfoot River, and for isolating the collection ditch and clarification pond from the fresh water environment should not leave any questions unanswered.
5. A dam across Alice Creek appears beneficial, and could even help lower the water table in the "wet" areas in the Blackfoot Valley. A 100-foot dam appears a better alternative than a 50-foot dam. In the case of a 100-foot dam, diversion would be westward, away from the area of possible pollution, and would create a larger recreation pond. A 100-foot dam would also do away with the ditch along the eastern edge of the tailings pond required by the 50-foot dam, and a possible diversion to bypass the clarification pond.

(Correction: It has been called to our attention that the grade of the Blackfoot diversion ditch should be -0.25% instead of -0.5%.)

SUMMARY
of
SURFACE WATER APPROPRIATIONS
in
LINCOLN DEVELOPMENT AREA

Name of Stream		Amount Appropriated
Blackfoot River		4,600 Miner's Inches
Anaconda Creek	Headwaters	100 " "
Teepee Lodge Creek		300 " "
Mike Horse Creek		10 " "
Bear Trap Creek		170 " "
Pass Creek	North	300 " "
Unnamed Spring	South	All
Cadotte Creek	North	280 " "
Willow Creek	South	40 " "
Jones Creek		30 " "
Trail Creek		150 " "
Sanborn (Sandbar) Creek		500 " "
Huckleberry Creek		100 " "
Alice Creek	North	6,000 " "
Toms Creek		500 " "
Lizzie (Bartlett) Creek		1,500 " "
Spring Creek		500 " "

EQUIVALENT MEASURES

One cubic foot of water	7.5	gallons
	62.4	pounds
	1728.	cubic inches
One cubic foot per second	7.5	gallons per second
	449.	gallons per minute
	1.	acre-inch per hour
	.99	acre-feet per 12 hours
	1.98	acre-feet per day
	723.	acre-feet per year
	646,000.	gallons per day
	40.	miners inches
		1 miners inch = 11.25 gpm
One acre-foot of water	326,000.	gallons
	43,560.	cubic feet, or one foot of water on one acre
One gallon of water	8.34	pounds
	231.	cubic inches
	.134	cubic feet
One gallon per minute	1440.	gallons per day
	.002	cubic feet per second
100 gallons per minute	.442	acre-feet per day
1,000,000 gallons per day	1.55	cfs
	694.	gpm
	3.07	acre-feet per day
	1121.	acre-feet per year
1 foot of water pressure	.433	pounds per square inch
1 pound per square inch	2.31	feet of water pressure